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Multistack Heat Recovery Chillers Cool and Heat Gettysburg Museum and Visitors Center

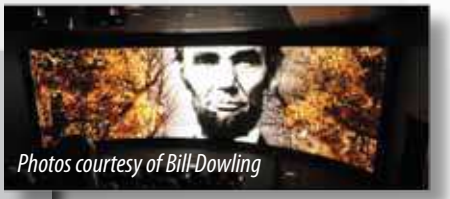
Modular heat recovery chillers help facility achieve artifact preservation goals, LEED Gold certification

Thanks to a new museum and visitors center equipped with Multistack™ Heat Recovery chillers, President Lincoln's immortal words and the heroic deeds of the Union and Confederate soldiers who fought at Gettysburg will continue to be remembered for many years to come.

The new visitors center and museum opened in May, 2008—the result of many years of planning. The new building includes exhibit galleries, temporary exhibit space, lower level storage and archives, restrooms, two 150-seat theaters, a full-service kitchen, catering kitchen, gift shop/bookstore, staff offices and conference room. Total conditioned space is nearly 122,500 square feet.

The new facility is situated in low terrain making it unnoticeable from other areas of the Gettysburg battlefield. It replaces a nearly 90-year-old visitors center that was no longer able to accommodate the numerous visitors or provide for the safe conservation of battlefield artifacts. The old building was situated on the historically significant land area known as Ziegler's Grove, the scene of heavy fighting. In 2009 the old museum was removed and the land is being restored to its 1863 features.

> "The world will little note nor long remember what we say here, but it can never forget what they did here."
>
> – President Abraham Lincoln, Gettysburg, Pennsylvania, November 19, 1863



Photos courtesy of Bill Dowling

In 2010 the new facility was awarded U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Gold certification. It is the first museum in Pennsylvania to achieve LEED Gold status and only the fourth museum nationwide.

Strict Temperature and Humidity Requirements

Although the soldiers who fought at Gettysburg 150 years ago sweltered in the July heat, the new museum's more than two million annual visitors remain completely comfortable no matter the season thanks to an innovative geothermal HVAC system. In addition to providing visitor comfort, proper temperature and humidity control are critical for long-term preservation of historic artifacts—including the spectacular, recently restored Gettysburg Cyclorama painting that depicts the epic three-day battle. Historic artifacts, documents and paintings require constant and specific dry-bulb temperature and relative humidity for best preservation.

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The Gettysburg National Military Park Visitors Center and Museum receives more than 1 million visitors each year. In 2010 it was awarded USGBC LEED Gold certification due to its energy-efficient geothermal HVAC system and other sustainable building design features.

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U.S. GREEN BUILDING COUNCIL MEMBER

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Many museums try to maintain a constant temperature with 45 to 55 percent relative humidity. For museums, temperature and humidity must be kept as constant as possible with little to no variation as fluctuations in temperature and humidity can cause damage to artifacts including brittleness, cracking, splitting and warping. In extreme cases, poor humidity control can cause mold. The Gettysburg Visitors Center and Museum design team specified a system that would maintain a temperature of 75 degrees F (± 3) and 50 percent relative humidity (±3 percent).

The design team also required a highly efficient HVAC system. After studying a variety of system designs considering the specific temperature, humidity and comfort level requirements, plus first cost and operating costs, the design team focused on using a geothermal system. Energy analysis models showed a 40 percent energy use cost savings of a geothermal system over a conventional chilled water/ hot water HVAC system. The geothermal system is on track to pay back its higher installed cost in only seven years.

The geothermal system was designed by Tatyana Shine, P.E. and CEO of Shine, Allen & Shariff of Columbia, Maryland. Shine worked with Boland in Rockville, Maryland, to select and install a 500-ton packaged heat recovery chiller plant. The plant includes two Multistack modular heat recovery chillers plus four plate heat exchangers, air separators, expansion tanks, valves, sensors and a digital controller.

Multistack Heat Recovery Chillers Ideal

Brian Shaffer, Facilities Director at the Gettysburg Visitors Center and Museum, said, "The Multistack heat recovery chillers were selected for multiple reasons including reliability, their modular design and their small footprint that was ideal for the limited equipment room space available."

Shaffer adds, "High efficiency and the ability to operate at an extended water temperature range were also very important factors in selecting the Multistack heat recovery chillers. They also feature reliable safety controls."

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Each of the two heat recovery chillers has five 50-ton scroll compressor modules for a total of 500 tons of cooling capacity. The chillers operate year-round and can generate 42-degree (F) chilled and 130-degree (F) hot water simultaneously. However, to further enhance energy efficiency, the heat recovery chillers are now set to produce 103-degree (F) hot water. At 42/130 the chillers demonstrate a combined heating/cooling COP of 9.36. Also, when the visitors center and museum first opened the intent was to have both chillers operating, but after fine-tuning the control system it was found that building temperature–and humidity can be maintained using only one of the heat recovery chillers. The second chiller serves as backup but is enabled during peak cooling load conditions.

Photos courtesy of Bill Dowling

According to Tatyana Shine, during summer operation the hot water generated in the condensers is used for reheat coils. If hot water return temperature exceeds the setpoint, a two-way valve at the condenser heat exchanger opens rejecting the excessive heat to the geothermal wells.

During winter months, hot water is directed to hot water coils but since the building cooling loads cannot provide enough heat for heating the building, the two-way valve at the evaporator heat exchanger opens allowing geothermal hot water into the return chilled water and condenser hot water loops to supplement heating.

The geothermal system includes 168 wells that extend 550 feet into the earth. Heat exchangers are installed between the return hot water loop and the geothermal water, and between the return chilled water loop and geothermal water.

Excellent Efficiency

According to Shine, the chiller EER is 30 and heating COP is 5.5 (COP is based on the average annual performance of the chiller generating 90-degree F water during the summer and 130-degree F water in the winter to heat the building). These efficiency ratings vary as building load and geothermal well temperatures change. The multiple compressors of the Multistack heat recovery modules provide better efficiency through optimum partial load matching. Only the compressors needed to meet temperature and humidity requirements are operated. This is much more efficient than operating a single 500-toncompressor, for example, at part load. Multiple modules also provide excellent redundancy and system reliability.

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The Multistack heat recovery chillers are performing very well with excellent energy saving efficiency. Facilities Director Brian Shaffer notes that he also gets excellent technical support from design team member Jim Fusco of Boland Company. Shaffer says, "We have called Multistack occasionally with questions and have been satisfied with the help and support so far."

In addition to LEED Gold certification, the Gettysburg Museum and Visitors Center received the 2009 Diamond Award from the American Council of Engineering Companies of Pennsylvania, and the 2009 National Recognition Award from the American Council of Engineering Companies. ☐

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